

*Excellence in Electronics***TYPE**  
**CK6152**

The CK6152 is a heater-cathode type low- $\mu$  triode of subminiature construction capable of operation in the UHF region. This type is characterized by long life and stable performance. It is designed for service where severe conditions of high temperature and mechanical shock or vibration are encountered. The flexible terminal leads may be soldered or welded directly to the terminals of circuit components without the use of sockets. Standard subminiature sockets may be used by cutting the leads to a suitable length.

**MECHANICAL DATA**ENVELOPE: T-3 GlassBASE: None (0.016" tinned flexible leads. Length: 1.5" min.  
Spacing: 0.048" center-to-center)TERMINAL CONNECTIONS: (Red dot is adjacent to lead 1)

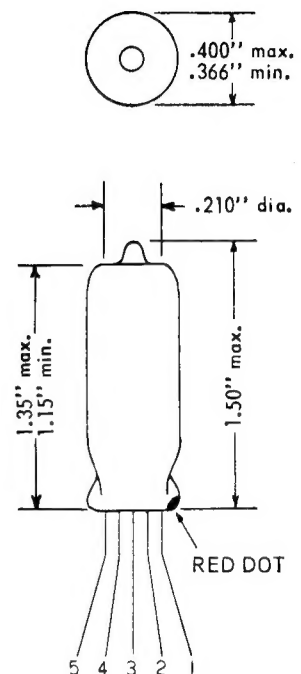
|                |               |
|----------------|---------------|
| Lead 1 Plate   | Lead 4 Heater |
| Lead 2 Cathode | Lead 5 Heater |
| Lead 3 Grid #1 |               |

MECHANICAL RATINGS:

|   |        |
|---|--------|
| Maximum Impact Acceleration (Shock Test - Note 3)                 | 450 G  |
| Maximum Uniform Acceleration (Centrifuge Test - Note 4)           | 1000 G |
| Maximum Vibrational Acceleration (100 Hour Fatigue Test - Note 5) | 2.5 G  |
| Maximum Bulb Temperature  | 265 °C |

MOUNTING POSITION: Any**ELECTRICAL DATA**

CAUTION-----To Electronic Equipment Design Engineers: Special attention should be given to the temperature at which the tubes are to be operated. Reliability will be seriously impaired if maximum bulb temperature is exceeded. The life expectancy may be reduced if conditions other than those specified for life test are imposed on the tube and will be reduced appreciably if absolute maximum ratings are exceeded. Both reliability and performance will be jeopardized if filament voltage ratings are exceeded. Life and reliability of performance are directly related to the degree that regulation of the heater voltage is maintained at its center rated value.



| RATINGS AND<br>NORMAL OPERATION: | MIL-E-1B<br>SYMBOL | ABSOLUTE<br>MINIMUM | NORMAL<br>TEST<br>CONDITIONS<br>(Note 7) | NORMAL<br>OPERATION<br>(Note 6) | ABSOLUTE<br>MAXIMUM | MIL-E-1B<br>UNITS |
|----------------------------------|--------------------|---------------------|--|---------------------------------|---------------------|-------------------|
| Heater Voltage (Note 8)          | Ef:                | 5.7                 | 6.3                                      | 6.3                             | 6.9                 | V                 |
| Plate Voltage                    | Eb:                | ----                | 100                                      | 100                             | 180                 | Vdc               |
| Grid #1 Voltage                  | Ec1:               | -55                 | 0  | 0                               | 0                   | Vdc               |
| Plate Dissipation                | Pp:                | ----                | ----                                     | 1.0                             | 1.1                 | W                 |
| Grid #1 Circuit Resistance       | Rg1:               | ----                | ----                                     | 1.0                             | ----                | Meg.              |
| Heater-Cathode Voltage           | Ehk:               | -200                | ----                                     | 100                             | +200                | Vdc               |
| Cathode Current                  | Ik:                | ----                | ----                                     | ----                            | 22                  | mAdc              |
| Cathode Resistance               | Rk:                | ----                | 270                                      | 270                             | ----                | ohms              |

**CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1)**

| TEST   | CONDITIONS                       | AQL<br>% | MIL-E-1B<br>SYMBOL | MIN. | LAL  | BOGIE | UAL  | MAX. | ALD  | MIL-E-1B<br>UNITS |
|--|----------------------------------|----------|--------------------|------|------|-------|------|------|------|-------------------|
| MEASUREMENTS ACCEPTANCE TESTS PART 1                       |                                  |          |                    |      |      |       |      |      |      |                   |
| Combined AQL = 1.0% excluding Mechanical and Inoperatives. |                                  |          |                    |      |      |       |      |      |      |                   |
| Heater Current:  |                                  | 0.65     | If:                | 183  | 190  | 200   | 210  | 217  | 16   | mA                |
| Heater-Cathode   |                                  |          |                    |      |      |       |      |      |      |                   |
| Leakage:   | Ehk = +100 Vdc<br>Ehk = -100 Vdc | 0.65     | { Ihk:             | ---- | ---- | ----  | ---- | 5    | ---- | $\mu$ Adc         |
| Grid Current:  |                                  | 0.65     | Ic (1):            | ---- | ---- | ----  | ---- | -0.3 | ---- | $\mu$ Adc         |
| Plate Current (1):   |                                  | 0.65     | Ib (1):            | 7    | 8.5  | 10    | 11.5 | 13   | 3.4  | mAdc              |
| Plate Current (2):   |                                  | 0.65     | Ib (2):            | ---- | ---- | ----  | ---- | 100  | ---- | $\mu$ Adc         |
| Transconductance (1):                                      |                                  | 0.65     | Sm (1):            | 4200 | 4600 | 5100  | 5600 | 6000 | 900  | $\mu$ mhos        |
| Continuity and Shorts                                      |                                  | 0.4      | ----               | ---- | ---- | ----  | ---- | ---- | ---- | ----              |
| (Inoperatives):  |                                  |          |                    |      |      |       |      |      |      |                   |
| Mechanical:  | Envelope (8-7) (Note 10)         | ----     | ----               | ---- | ---- | ----  | ---- | ---- | ---- | ----              |

Tentative Data

**RAYTHEON MANUFACTURING COMPANY**

RECEIVING AND CATHODE RAY TUBE OPERATIONS



## RELIABLE SUBMINIATURE TRIODE

## ELECTRICAL DATA (Cont'd)

## CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1)(cont'd)

| TEST  | CONDITIONS  | AQL<br>% | MIL - E - 1B<br>SYMBOL  | MIN.                | LAL   | BOGIE               | UAL   | MAX.               | ALD   | MIL - E - 1B<br>UNITS                                    |
|---|---|----------|---|---------------------|-------|---------------------|-------|--------------------|-------|--|
| <b>MEASUREMENTS ACCEPTANCE TESTS PART 2</b> |   |          |   |                     |       |                     |       |                    |       |  |
| Insulation of<br>Electrodes:                | $E_f = 6.3 \text{ V}$<br>$E_g - \text{all} = -100 \text{ Vdc}$<br>$E_p - \text{all} = -300 \text{ Vdc}$   | 2.5      | $\begin{cases} R_{g1 - \text{all}}: \\ R_{p - \text{all}}: \end{cases}$ | 100<br>100          | ----  | ----                | ----  | ----               | ----  | Meg.   |
| Transconductance (2):                       | $E_f = 5.5 \text{ V}$   | 2.5      | $\Delta E_f S_m (2):$   | ----                | ----  | ----                | ----  | 10                 | ----  | %  |
| Grid Emission:                              | $E_b = 100 \text{ Vdc}$ ; $R_g = 1.0 \text{ meg}$ ;<br>$E_f = 7.5 \text{ V}$ ; $R_k = 270 \text{ ohms}$ ;<br>preheat 5 minutes at $E_c1 = 0$ ; Test at $E_c1 = -45 \text{ Vdc}$ | 2.5      | $I_c (2):$  | ----                | ----  | ----                | ----  | -0.6               | ----  | $\mu\text{Adc}$  |
| AF Noise:                                   | $E_{sig} = 70 \text{ mVac}$ ; $E_c1 = -5.5 \text{ Vdc}$ ; $R_g = 0.1 \text{ Meg}$ ;<br>$R_p = 0.01 \text{ Meg}$ ; $R_k = 0$   | 2.5      | EB:   | ----                | ----  | ----                | ----  | 17                 | ----  | VU   |
| Amplification Factor:                       |   | 6.5      | $\mu_u$ :   | 14.5                | 15.5  | 17.5                | 19.5  | 20.5               | 3.5   | -----  |
| Capacitance:                                |   | 6.5      | $\begin{cases} C_{gp}: \\ C_{in}: \\ C_{out}: \end{cases}$              | 0.95<br>2.1<br>0.91 | ----- | 1.32<br>2.9<br>1.28 | ----- | 1.7<br>3.7<br>1.61 | ----- | $\mu\mu\text{f}$<br>$\mu\mu\text{f}$<br>$\mu\mu\text{f}$ |
| Capacitance:                                | Note 2  | 6.5      | -----   | -----               | ----- | -----               | ----- | -----              | ----- | -----  |
| Low Pressure                                | Pressure = $55 \pm 5 \text{ mm Hg}$ ;   | 6.5      | -----   | -----               | ----- | -----               | ----- | -----              | ----- | -----  |
| Voltage Breakdown:                          | Voltage = $300 \text{ Vac}$   | 2.5      | Ep:   | -----               | ----- | -----               | ----- | 25                 | ----- | mVac   |
| Vibration (2):                              | $F = 40 \text{ Cps}$ ; $G = 15$ ; $R_p = 10,000 \text{ ohms}$   | 2.5      | Ep:   | -----               | ----- | -----               | ----- | 25                 | ----- | mVac   |

## DEGRADATION RATE ACCEPTANCE TESTS

|   |   |       |                      |       |       |       |       |       |       |                      |
|---|---|-------|----------------------|-------|-------|-------|-------|-------|-------|----------------------|
| Subminiature<br>Lead Fatigue:                                 |   | 2.5   | -----                | 4.0   | ----- | ----- | ----- | ----- | ----- | arcs                 |
| Shock:  | Hammer Angle = $30^\circ$<br>(Note 3)   | 20    | -----                | ----- | ----- | ----- | ----- | ----- | ----- | -----                |
| Fatigue:  | 96 Hours; $G = 2.5$ ; Fixed<br>frequency; $F = 25 \text{ min.}$<br>60 max. (Note 5) | 6.5   | -----                | ----- | ----- | ----- | ----- | ----- | ----- | -----                |
| Post Shock and Fatigue<br>Test End Points:                    |   |       |                      |       |       |       |       |       |       |                      |
| Vibration (2):  | $F = 40 \text{ Cps}$ ; $G = 15$ ; $R_p = 10,000 \text{ ohms}$                       | ----- | Ep:                  | ----- | ----- | ----- | ----- | 100   | ----- | mVac                 |
| Heater - Cathode<br>Leakage:                                  | $E_{hk} = +100 \text{ Vdc}$   | ----- | $I_{hk}$ :           | ----- | ----- | ----- | ----- | 20    | ----- | $\mu\text{Adc}$      |
| Change in Transcon-<br>ductance (1) of in-<br>dividual tubes: | $E_{hk} = -100 \text{ Vdc}$<br>$E_f = 6.3 \text{ V}$                                | ----- | $\Delta I_{sm} (1):$ | ----- | ----- | ----- | ----- | 20    | ----- | $\mu\text{Adc}$<br>% |
| Glass Strain (Thermal<br>Shock):                              |   | 2.5   | -----                | ----- | ----- | ----- | ----- | ----- | ----- | -----                |

| TEST  | CONDITIONS   | AQL<br>% | MIL - E - 1B<br>SYMBOL                         | MIN.           | MAX.     | MIL - E - 1B<br>UNITS              | Max. Defects<br>per characteristic<br>1st Sample | Combined<br>Sample |
|---|--|----------|--|----------------|----------|------------------------------------|--|--------------------|
| <b>ACCEPTANCE LIFE TESTS</b>                                  |  |          |  |                |          |                                    |  |                    |
| Heater Cycling<br>Life Test:                                  | $E_f = 7.5 \text{ V}$ ; $E_b = E_c1 = 0 \text{ V}$ ; $E_{hk} = 140 \text{ Vac}$ ;<br>1 min. on, 1 min. off | -----    | -----  | 2000           | -----    | cycles                             | ---  | ---                |
| Heater Cycling Life<br>Test End Points:                       |  |          |  |                |          |                                    |  |                    |
| Heater - Cathode<br>Leakage:                                  | $E_{hk} = +100 \text{ Vdc}$<br>$E_{hk} = -100 \text{ Vdc}$   | 1.0      | $\begin{cases} I_{hk}: \\ I_{hk}: \end{cases}$ | -----<br>----- | 20<br>20 | $\mu\text{Adc}$<br>$\mu\text{Adc}$ | ---  | ---                |
| 1 Hour Stability<br>Life Test:                                | $T_A = \text{Room}$ ; $E_{hk} = +200 \text{ Vdc}$ ; $R_g = 1.0 \text{ Meg.}$                               | -----    | -----  | -----          | -----    | -----                              | ---  | ---                |
| 1 Hour Stability<br>Life Test End Points:                     |  |          |  |                |          |                                    |  |                    |
| Change in Transcon-<br>ductance (1) of in-<br>dividual tubes: | (Typical Sample Size =<br>50 tubes)  | 1.0      | $\Delta I_{sm} (1):$                           | -----          | 10       | %                                  | ---  | ---                |
| 100 Hour Survival Rate<br>Life Test:                          | $T_A = \text{Room}$ ; $E_{hk} = +200 \text{ Vdc}$ ; $R_g = 1.0 \text{ Meg.}$                               | -----    | -----  | -----          | -----    | -----                              | ---  | ---                |
| 100 Hour Survival Rate<br>Life Test End Points:               | (Typical Sample Size =<br>200 tubes)   | -----    | -----  | -----          | -----    | -----                              | ---  | ---                |
| Inoperatives:   |  | 0.65     | -----  | -----          | -----    | -----                              | ---  | ---                |
| Transconductance (1):   |  | 1.0      | $S_m (1):$                                     | 3600           | -----    | $\mu\text{mhos}$                   | ---  | ---                |

RAYTHEON MANUFACTURING COMPANY

RECEIVING AND CATHODE RAY TUBE OPERATIONS



## RELIABLE SUBMINIATURE TRIODE

## ELECTRICAL DATA (Cont'd)

| CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1) (cont'd)   |  |          |                            |      |      |                       |   |     |
|---|--|----------|----------------------------|------|------|-----------------------|---|-----|
| TEST  | CONDITIONS   | AQL<br>% | MIL - E - 1B<br>SYMBOL     | MIN. | MAX. | MIL - E - 1B<br>UNITS | Max. Defects<br>per characteristic<br>1st Sample Combined<br>Sample |     |
| ACCEPTANCE LIFE TESTS (cont'd)                                |  |          |                            |      |      |                       |   |     |
| 500 Hour Intermittent High Temperature Life Test:             | T Bulb=250°C; Ehk=+200 Vdc; Rg=1.0 Meg.  | ----     | -----                      | ---- | ---- | -----                 | ---   | --- |
| 500 Hour Intermittent High Temperature Life Test              | (Typical Sample Size=20 tubes 1st sample   | ----     | -----                      | ---- | ---- | -----                 | ----  | --- |
| End Points:   | 40 tubes 2nd sample)   | ----     | -----                      | ---- | ---- | -----                 | ---   | --- |
| Inoperatives:   |  | ----     | -----                      | ---- | ---- | -----                 | 1   | 3   |
| Heater - Current:   |  | ----     | If:                        | 180  | 220  | mA                    | 2   | 5   |
| Heater - Cathode Leakage:                                     | Ehk=+100 Vdc   | ----     | lhk:                       | ---- | 10   | μAdc                  | } 2   | 5   |
|   | Ehk=-100 Vdc   | ----     | lhk:                       | ---- | 10   | μAdc                  |   |     |
| Grid Current (1):   |  | ----     | Ic (1):                    | ---- | -1.0 | μAdc                  | 1   | 3   |
| Transconductance (1) change of individual tubes from initial: |  | ----     | Δ <sub>f</sub> Sm(1):      | ---- | 20   | %                     | 1   | 3   |
| Average Change:   |  | ----     | Ave. Δ <sub>f</sub> Sm(1): | ---- | 15   | %                     | ---   | --- |
| Insulation of Electrodes:                                     |  | ----     |                            |      |      |                       |   |     |
| g-all   |  | ----     | Rg1-all:                   | 50   | ---- | Meg.                  | } 2   | 5   |
| p-all   |  | ----     | Rp-all:                    | 50   | ---- | Meg.                  |   |     |
| Transconductance (2):   |  | ----     | Δ <sub>Ef</sub> Sm(1):     | ---- | 15   | %                     | 2   | 5   |
| Total Defectives  |  | ----     | -----                      | ---- | ---- | -----                 | 4   | 8   |
| 1000 Hour High Temperature Information Life Test:             | T Bulb=250°C; Ehk=+200 Vdc; Rg=1.0 Meg.  |          |                            |      |      |                       |   |     |
| 1000 Hour High Temperature Information Life Test End Points:  | Read for same characteristics as for 500 Hour Intermittent High Temperature Life Test. Limits not established. |          |                            |      |      |                       |   |     |

## NOTES:

- Note 1: Characteristics, Quality Control Test Procedures, and Inspection Levels are made according to the appropriate paragraphs of MIL - E - 1B, "Inspection Instructions for Electron Tubes," and MIL-STD-105A.
- Note 2: Without shield.
- Note 3: Test conditions and acceptance criteria per Shock Test procedures of MIL - E - 1B basic specifications.
- Note 4: Centrifuge Test with forces applied in any direction.
- Note 5: Test conditions and acceptance criteria per Fatigue Test procedures of MIL - E - 1B basic specifications.
- Note 6: These normal values represent conditions at which control of reliability may be expected.
- Note 7: These normal test conditions are used for all characteristic tests unless otherwise stated under the individual test item.
- Note 8: For most applications the performance will not be adversely affected by ± 10% heater voltage variation, but when the application can provide a closer control of heater voltage, an improvement in reliability will be realized.
- Note 9: Change of transconductance for individual tubes from that value measured at Ef=6.3 V to that value measured at Ef=5.5 V.
- Note 10: In addition to meeting the tightened electrical, physical and mechanical tests described in this data sheet these Raytheon Reliable Tubes are now guaranteed to be free from "potential" defects identifiable by microscopic inspection as described by paragraph 5.3.8 of "Inspection Instructions for Electron Tubes."